UNPUBLISHED
SURVEY & CONTROL
REPORTS

INTERMOUNTAIN STATION
Central Reference File
No. 3.4163-51

UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY

FOREST INSECT INVESTIGATIONS

METHOD OF CONDUCTING EXTENSIVE SURVEYS of MOUNTAIN PINE BEETLE INFESTATIONS

J. C. Evenden

by

James C. Evenden
Entomologist

1931

U. S. GOVERNMENT PRINTING OFFICE: 1931 J 76133

FILE COPY
MISSOULA
FOREST INSECT
LABORATORY

METHOD OF CONDUCTING

EXTENSIVE SURVEYS OF MOUNTAIN PINE BEETLE INFESTATIONS

****

JAMES C. EVENDEN
ENTOMOLOGIST

BUREAU OF ENTOMOLOGY
FOREST INSECT FIELD STATION
COEUR D'ALENE, IDAHO
JULY 21, 1931

METHOD OF CONDUCTING EXTENSIVE SURVEYS OF MOUNTAIN PINE BEETLE INFESTATIONS

- - - - - - -

Extensive forest insect surveys are now considered as a part of the regular duties of many forest officers. The need for detailed instructions relative to conducting such surveys in a manner so as to produce a standardized and accurate result is recognized. This realization has prompted the preparation of this paper in the hope that it will prove to be of assistance to those charged with this responsibility. The need for standardized and efficient performance in the execution of forest insect surveys can not be over-emphasized, as from the data secured the results of control operations are determined, as well as future plans for control involving the expenditure of large sums of money. Though the execution becomes a somewhat mechanical procedure, the careful planning of such surveys is essential if the best results are to be secured.

To secure information relative to the status of an infestation, without surveying a large per cent of the area, data must be taken from small samples of the region and applied to the total acreage of the territory under consideration. The accuracy of such a survey depends, of course, upon the selected samples being representative of the area. It has been found that the fairest samples are secured by running a series of strips through the region in question. As in all bark beetle outbreaks infested trees are found scattered throughout large areas, these strips have been found to give more reliable data than small plots located at definitely stated distances. Such strips must always include not only the areas of known infestation evidenced by the presence of red-topped trees killed the previous season, but adjacent regions as well, if information relative to the extent of the infestation is to be made available. Sample strips must also include the nonproductive portions of the territory such as patches of reproduction, openings, burns, non-host timber types, etc.

Location of Sample Strip

In the location of sample strips one must always bear in mind that the objective is the securing of a fair sample of the area to which the strip data is to be applied. Though the selection of sample strip location is a somewhat mechanical procedure, good judgment must always be used in determining the general direction that strips are to be run, and the portions of the areas which should be sampled. As an example, strips run along creek bottoms or along the tops of ridges would not be indicative of average conditions throughout the area. Likewise, strip run only in "bug timber" would not be a fair sample unless a proportionate amount of strip was run in nonsusceptible timber types, sagebrush, openings, etc.

As an example of what is meant by a fair sample: An area of 1920 acres with 60 per cent bug timber, 20 per cent old burn covered by reproduction, and 20 per cent non-host species and sagebrush is being surveyed. If six miles of strip were run in such an area, 28.8 chains should be in the bug timber and 19.2 chains in the reproduction and non-host material, if a fair sample is secured. It is, of course, impossible to work out such detailed percentages of strip location in actual practice, so all that can be done is to run strip through the area on general compass lines in such a manner that all exposures, etc., will be fairly represented. The psychology of a so-called "bug hunter" shows that a successful day while on an insect survey is one on which a large number of infested trees are encountered. This reaction results from the unconscious desire of the cruiser to find that for which he is hunting. Unconsciously one finds himself running sample strip in areas where the greatest number of bug trees are apt to be found. A group of red-top trees a half mile away has been known to seriously affect the magnetic pull of a compass needle. For this reason, so that the cruiser will take the "bitter with the sweet", strip lines must be projected from a starting point on a mechanical basis. In other words, the strip line should start at some arbitrary point, run in a definite direction for the desired distance, then an offset and the return to the starting point by the reverse compass bearings. Strip lines assume different patterns, depending upon the area being covered. In large areas the most common form is a long rectangle, the two long sides being separated with an offset of one half mile or more. With smaller areas the form may be in the shape of a triangle, square, or the mere gridironing of an area with short strip one half mile or so apart. However, in all cases these strips must be projected on a general compass bearing so that the cruiser will know where he is expected to go, and to insure his traversing such nonproductive areas as sagebrush flats, reproduction, etc., when they are encountered.

The foregoing discussion is only applicable to those areas where the acreages or boundaries of susceptible bug timber are not known. For when such regions are being surveyed the only procedure that can be followed is to secure data from a small portion of the area and apply it to the total acreage under consideration. On the other hand, when the boundaries of susceptible bug timber are known, the survey strips can be confined to these areas, which will eliminate a lot of unproductive labor and permit the securing of a larger sample from which the final estimates must be based. However, the boundary lines of timber types should not be too finely drawn, and the cruising of small patches of timber should be avoided whenever possible. Small areas should be blocked into larger units and the total acreage covered by sample strips. When possible acreages should be computed from section lines, and sample strip run in accordance.

Though, as stated, the location of these strip lines is a mechanical procedure, such action must always be tempered with the good judgment of the chief of party. As for example, a starting point is selected and a strip projected to extend N. 45° W. for a distance of four miles, then to

run N. 45° E. for one mile, then S. 45° E. for four miles, and a return to the starting point by a mile run S. 45° W. Though such a procedure seems fairly simple the chief of party must carefully study his area to determine the starting point, general compass bearings, etc., in order that the 10 miles of strip line will produce the best representative sample of the region under consideration and result in the most efficient performance for his crew. Such careful thought can not be supplanted by prescribed rules or regulations, as one will find that each area presents a problem of its own requiring individual study for its proper solution. There are, however, a few rules relative to strip location which one should bear in mind as they are applicable for all areas.

1. Strip lines must not be projected along trails, ridges, or streams.

2. Strips should be run perpendicular and not parallel to the course of the drainage being covered. This rule can not be followed in connection with the small side streams or draws associated with the main drainage being covered. In running strip across a drainage a sample of different elevations, types, etc., is secured.

3. Strips may be run along section lines, if such a compass bearing gives a representative sample of the area.

4. Strip can be projected from a selected starting point in any direction. The direction of such strip should be selected and plotted upon the cruiser's map prior to the start of each day's work, and only under very unforeseen conditions should any departures be made from it.

5. Strip can be extended in any geometric pattern best suited to fit the requirements of the area and still return the cruiser to the starting point, or to some place where he is to be met with transportation.

6. Strips should be planned, as far as possible, to eliminate long walks to the starting points, or back to camp at the close of the day's work.

7. Where impassable swamps, lakes, rock slides, cliffs, etc., are encountered, an offset can be made. However, in making such offsets, only the distance parallel to the general course being followed should be recorded as distance traveled, and no record kept of the newly attacked trees encountered, as it is evident that there would be none in the swamps, lakes, etc.

Width of Sample Strip

It has been found that the most efficient width of strip is one chain (66 feet). This width permits the cruiser to follow a center line

and spot the newly attacked trees on each side for a distance of 33 feet, and it is very seldom that he will be required to leave his center line. Trees on the border line of his strip or those with the base surrounded by brush will require more careful observation.

Compass Line

Though strips are run upon a compass line, the expression general compass bearing has been used. A compass is used in order to keep the cruiser upon his course; however, for the purpose of this survey an accurate compass line is not necessary. For example, the chief of party projects a line to run N. 30° W. This direction was selected as being one which in his judgment would give the best sample of the area. The general course may be entirely correct, but the actual bearing is only an arbitrary selection. So there is no need to follow accurately the 30° bearing, as a departure of several degrees at the end of the strip would have no material bearing upon the results secured and might even give a more accurate result. Long shots, utilizing the angle of the shadows, or keeping the sun in definite positions, will provide a sufficiently accurate course. In following such a procedure what a cruiser actually does is to zigzag across the prescribed compass bearing, and during the course of a 4 or 5-mile strip the errors in direction will nearly always compensate each other. Too much attention has often been paid to the running of strip on an accurate compass bearing, which has reduced the daily output per man-day. By eliminating this unnecessary labor and following a general bearing the amount of strip which can be run in a day will be materially increased and better data secured. The standard Forest Service compass is not necessary as it has been found that the small pocket box compass is much faster and sufficiently accurate. The amount of strip which one man can run in a day depends upon the nature of the terrain being covered, so it is very difficult to attempt to prescribe a standard output. On the Coeur d'Alene survey (1930) (steep, brushy, white pine type) the men averaged 4.17 miles per effective man-day. On the Beaverhead survey (1930) (average lodgepole type?) 8.7 miles were averaged per effective man-day.

Operation or Mechanics of Running Sample Strip

The equipment necessary for the running of sample strip on extensive insect surveys is a pocket box compass, two tally registers, strip sheet forms, pencils, map of area, and a full realization of the importance of the task. Each cruiser must be able to pace, which is not difficult to learn. In learning to pace one must first determine how many double paces one steps in a natural walking gait to cover a distance of one chain. This number will vary from 11 to 13. As horizontal distances are measured, the number of paces must be changed for steep slopes. On very steep slopes it is often necessary to estimate the number of double paces required to cover short distances. In pacing a tally register is used to record the number of double paces. With a

little practice the recording of these paces becomes automatic, for if the tally register is carried in the left hand it will be depressed with each backward swing of the left arm as the right foot strikes the ground. As stated, this soon becomes automatic and leaves one's mind free to look for bug trees, the eyes moving from side to side with each step, and also eliminates all mistakes which occur when one attempts to count steps and record chains. The other tally register is used to record the number of bug trees counted.

In lodgepole pine the best results are secured by each cruiser working alone. This cruiser runs his strip along the prescribed compass line (see Compass Line), paces the distance covered, and counts the newly attacked trees on a strip one chain in width (see Width of Strip). A form is used upon which the data are recorded. The number of new attacks is recorded for every 10 chains. This gives their general location, and the data secured can then be subsequently plotted upon a map to show the areas of heaviest infestation. Where no new attacks are encountered no record need be made, and often a cruiser can go for a mile or more without making any entries upon the form (see Sample Form). However, as soon as infested trees are encountered the nonproductive portion of the strip is recorded and the infested tree allotted to the 10 chains of strip where they were found. At the close of each day's work the survey sheets are summarized by each cruiser and turned over to the chief of party, who in turn summarizes all sheets for the day. Such a summary consists of the number of miles or chains covered, number of acres, number of new attacks recorded, number of new attacks per acre of strip. When all of the survey sheets for each unit of the area have been summarized, the average number of new attacks per acre is then applied to the total acreage of the region covered. The results of such surveys when carefully performed give very accurate information, and can be used for the basing of future plans of control.

In the planning of such surveys the chief of party should always have a carefully prepared plan showing a complete itinerary of camp locations, time to be spent at each camp, etc., before the start of the project. He should also have a map showing the strip lines that he intends to run from each camp. Such a plan will result in more accurate data, eliminate unnecessary duplication of strip, moves, etc., and prevent confusion in the event of the chief of party being removed through sickness, etc. At the close of each day's work each cruiser should plot upon the map his actual strip, as it is realized that some field changes from the planned course will be necessary. In plotting these strips a different colored ink should be used, and the number of infested trees recorded should be marked at the side of the strip to show their location. Each cruiser should place the date and his initials by the side of his plotted strip. (A sample map is attached to this circular.)

On the strip sheet there is a column for "Remarks". Under "Remarks" such items as the character of the timber being covered, sagebrush, burns, reproduction, good or poor bug timber, etc., should be listed. Notes as to

the character of the infestation, etc. should also be given. On the sample form attached to this circular a number of these items have been listed.

In white pine there is some question as to the possibility of securing a greater efficiency by having two men work together, one man to run compass, pace, keep records, and cover a strip one-half chain in width, the other man to cover a strip 1½ chains in width. It is thought that due to the roughness of the terrain, underbrush, etc., this method may prove to be more effective. Some tests of its effectiveness will be made during the coming season.

Per Cent of Area to be Covered by Survey

This is a difficult question to answer, as theoretically the larger the per cent covered the more accurate the results. The percentage covered will also depend upon the size of the area and the man power available. At least 1¼ per cent of the area should be covered by these surveys, and as much more as possible, as the increased percentage will give greater accuracy in the results obtained.

Spotting of Infested Trees

As these extensive surveys are conducted during August, September, and October, there is no fading of the foliage on the newly attacked trees. It is therefore necessary to depend entirely upon the pitch tubes on the bole of the trees and the boring dust at the base. These indications of attack are very easy to see when one has trained his eyes to look for them. When one keeps his eyes to the base of the trees better results are obtained.

All newly attacked trees are recorded. No attention is paid to what may prove to be a "pitched out" tree next spring, as the counting of such trees compensates for the one-sided attacks which when occurring on the side opposite to you will be missed.

Conclusions

It is hoped that these instructions for the making of extensive insect surveys will be of assistance to those charged with this very important task. Considerable detail has been gone into, but it is still possible that there are some important points that have been omitted. The writer assures you that he is anxious to be of assistance to you and will try and answer any question you may care to ask relative to any point in this memorandum not fully covered.

James C. Evenden
Entomologist

Forest Insect Field Station,
Coeur d'Alene, Idaho.

Mill Creek Unit Targhee 1 Aug. 23, 1931
Region Sheet No. Date
Bridge on Mill Creek. Sec. line between 1 and 12
Starting Point

Henry Jones
Signature

Bearing	Chains	N.A.	Remarks
N 40° W	1-20	--	sagebrush
	21-30	4	Old mature trees
	31-40	3	" " "
	41-50	1	Smaller trees
	51-120	0	Small pole stand
	121-130	4	Group of large trees
	131-200	0	Poles-Last 20 sagebrush
	201-210	2	Mature trees
	211-220	10	One big group inf.trees
	221-230	9	Same group
	231-300	0	Mature trees
	301-310	5	Heavy infested
	311-320	10	Same group
N 60 E	1-70	0	30 in sagebrush
S 40 E	1-40	--	Sagebrush
	41-90	--	Pole stand
	91-100	5	Mature trees
	101-110	10	" "
	110-200	--	Poles - some mature
	201-220	7	Scattered - Mature
	221-230	9	Scattered - "
	231-240	3	" "
	241-310	--	Sagebrush - Poles - Little Mature - Road

Summary to be placed on bottom or back of sheet.

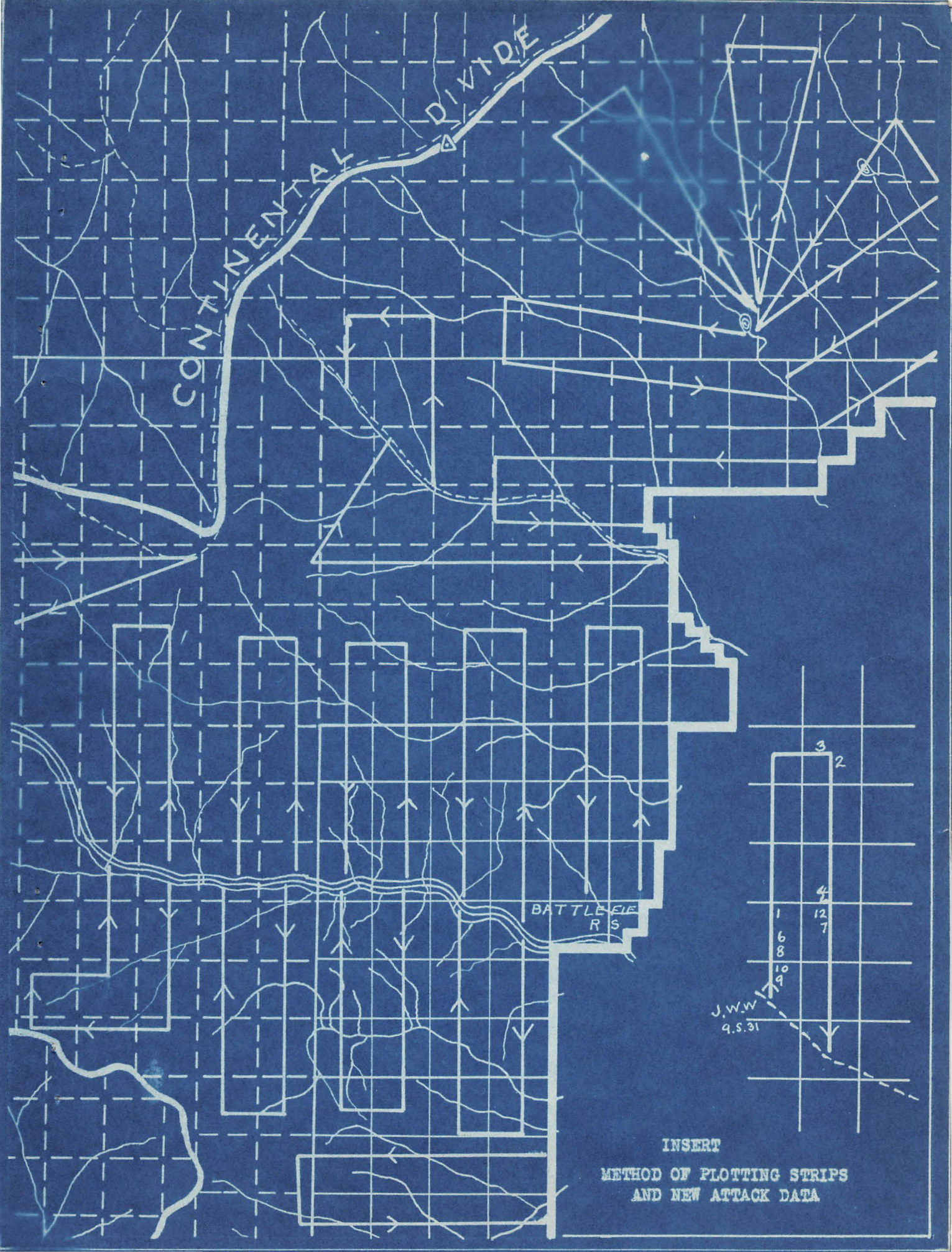
Chains - 670
Miles - 8-3/10
Acres - 67
New Attacks - 82
N.A. per strip A-1.22

MAP SHOWING SAMPLE STRIP LINES
AND METHOD OF RECORDING DATA
UPON MAP

- - - - - -

Map Data

Total acres in infested area	127,360
Miles of sample strip	.171
Areas covered by sample strip	1,368
Per cent of total area covered by strip	1.07
Total new attacks recorded	1,058
New attacks per acre	.773
New attacks for total area	98,449



INSERT

METHOD OF PLOTTING STRIPS
AND NEW ATTACK DATA